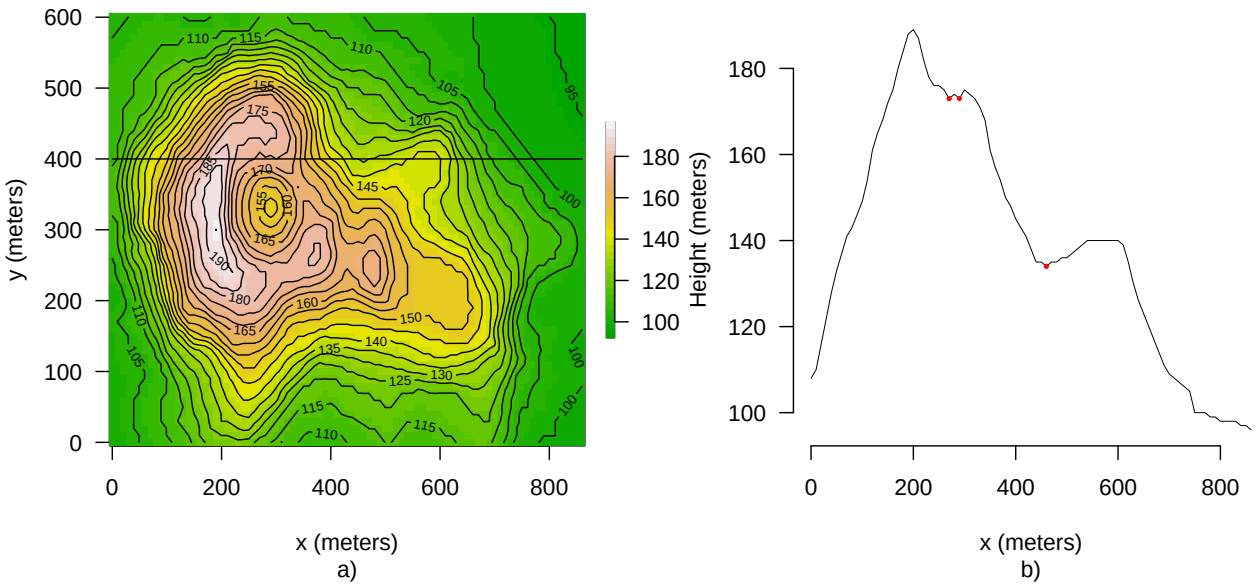
Homework #3

Maunga Whau (Mt Eden) is one of about 50 volcanos in the Auckland volcanic field. This data set (`?volcano`) gives topographic information for Maunga Whau on a 10m by 10m grid. *Figure a)* shows contour plot of the volcano Maunga Whau. *Figure b)* shows the cross-section of the volcano at `y = 400m`. Answer the following questions in the light of this information.

```
z <- volcano # Store volcano data in z
x <- (0:(nrow(z) - 1)) * 10 # x-values
y <- (0:(ncol(z) - 1)) * 10 # y-values
y400 <- z[,41] # heights at y = 400m
```



Q1:(10pts) Answer the questions below using R;

1. What is the *maximum height* of the volcano?
2. What is the `[x, y]` coordinate of maximum height?
3. What is the *minimum height* of the volcano?
4. What is the `[x, y]` coordinate of minimum height?

Q2:(30pts) Data at 6 cells in the matrix (`z`) was removed because of quality assurence *(run the command below)*.

```
z <- volcano # Store volcano data in z
set.seed(1)
indices <- round(runif(6, 1, length(z))) # indices to set NA
z[indices] <- NA # set to NA in purpose
```

1. Find the `x` and `y` coordinates of `NA`s.
2. Fill the `NA`s by mean of the 8 values surrounding `NA` cell.

Q3:(30pts) *Figure b)* shows the cross-section of the volcano at `y = 400m` and local minimum heights on the volcano *(red points)*. Write an R expression to detect/find the local minimums in the `y400` vector. How far the local minimums are away from the left (zero)? Discuss your results with the *figure b)* (**Hint:** `?diff, ?sign, ?which`)

Q4:(30pts) Find slopes at the locations `y = 400` and `x = seq(5, 855, 10)` meters. What are the location and value of steepest slope *(negative or positive)*? What would be the best place for a climber needs a rest?